

may yet be high, and the signal is "CAUTIONARY" WITH REFERENCE TO WINDS EXPECTED TO BLOW FROM THE NORTH OR WEST OR FROM A DIRECTION BETWEEN THOSE POINTS, at or near the place at which it may be displayed.

The order to display signals will be accompanied with a brief message giving the location and probable movement of storm-centre, the direction, and anticipated changes in the direction and force of the wind in the Lake region, and when practicable, for each Lake. The observers in charge of Signal stations on the Lakes, as well as all displaymen, will bulletin the order to display signals as well as the accompanying message, and any succeeding explanatory message, at such points as will secure the greatest publicity to the shipping interests, and will take any other steps that will ensure the greatest distribution to the parties interested in this information.

R. C. DRUM,  
Adjutant General, and  
Acting Chief Signal Officer of the Army.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges, during the month of February, 1881. With the exception of the Red River, in which the range, though considerable, was quite evenly distributed through the month, there have been very high and rapid rises in the navigable rivers. The Arkansas at Little Rock rose very rapidly from the 6th to 20th reaching its highest point on the latter date. The Mississippi at stations below St. Louis reached its maximum stage between the 24th and 28th; at Cairo, on the former date, the water reached a point 2 feet and 6 inches above the danger line. In the Ohio the highest stage was reached between the 11th and 17th, the water at Cincinnati rising 9 inches above the danger line on the 16th, and at Pittsburg 38 inches above on the 11th. The Cumberland at Nashville reached its highest stage on the 23rd and the Tennessee at Chattanooga on the 13th. At Morgantown and Pittsburg, on the Monongahela, the changes were rapid and very dangerous, the maximum stage being reached on the 10th and 11th. On the Pacific coast the navigable rivers north of San Francisco reached the highest stage of water between the 4th and 7th.

*Ice in Rivers and Harbors.*—The following items, relative to the formation of ice in such bodies of water throughout the northern section of the country, exhibit the same for the month of February, 1881. The Missouri and that portion of the Mississippi river from Keokuk northward have remained frozen during the month. At all Lake stations ice is reported firm and navigation closed. *Columbia River.*—Umatilla, Or., 1st to 4th, full of floating ice; 6th, free of ice, navigation resumed. *Umatilla River.*—Umatilla, Or., 1st to 4th, full of floating ice; 6th, free of ice. *Yellowstone River.*—Ft. Keogh, 28th, frozen over during month, but now threatening to break up. *Poerder River.*—Ft. Keogh, 28th, frozen over during month, but now threatening to break up. *Missouri River.*—Leavenworth, 6th, ice rising and cracking along banks; 7th, ice gorged; 8th, ice settled and again solid; 28th, ice 20 inches in thickness, teams crossing daily. *Kansas River.*—Lawrence, 7th, frozen over since November 18th, 1880; 8th to 16th, partly open; 17th to 28th, frozen over. *Des Moines River.*—Keokuk, 10th, river open to its mouth, ice gorged two-thirds the way across the Mississippi. *Mississippi River.*—Keokuk, 5th, to 26th, teams crossing on ice. St. Louis, 1st, ice gorged in Carondelet harbor; 3rd, ice solid above and below bridge, people crossing; 4th, one mile of gorge in Carondelet harbor moved out; 7th, river clear south of bridge; 8th, gorge above bridge, intact and covered with water; 9th, gorge gave way about noon, several boats damaged; 10th to 28th, river full of heavy floating ice; 15th, steamer "City of Granville" arrived from the south, first vessel since November 16th, 1880; 16th, ferries stopped by heavy floating ice. Dubuque, 28th, ice in river 32 inches in thickness. Cairo, 1st to 7th, river frozen over; 8th to 24th, full of floating ice; 14th, navigation resumed; 25th, entirely clear. Memphis, 14th, floating ice, water rising rapidly, endangering property. *Chicago River.*—Chicago, 9th, ice breaking up and passing out. *El River.*—Logansport, Ind., 6th, ice 22 to 25 inches thick; 10th, ice broke up and passed out, causing great destruction to bridges and other property. *Wabash River.*—Logansport, Ind., 10th, ice passed down river, occasionally interrupted by heavy gorges; the destruction to property almost without parallel. *St. Clair River.*—Port Huron, 9th, ice breaking up and passing down into St. Clair Flats. *Maumee River.*—Perrysburg, 9th, ice breaking up and forming heavy gorges; 10th, gorge broken, but formed at a point four miles below. Toledo, 11th, 7 p. m., ice gorged above city, 10 p. m., gorge broke, flooding a portion of city to the depth of several feet; six schooners loaded with wheat carried down by the ice through the railroad bridges, destroying a span of each bridge; 12th, gorged below city, backing up the water, flooding Water street to a depth of six feet, Island House and Lake Shore depot flooded, freight cars submerged, cellars filled, the water rising above the lower floors of dwellings, business entirely suspended; 14th, ice gorge intact, flood still continues, damage to property estimated at \$3,000,000. *Ohio River.*—Cincinnati, 1st to 15th, full of floating ice; 16th to 28th, clear. Vevay, Ind., 3rd, full of floating ice, great difficulty in landing, navigation suspended; 6th, full of heavy ice, no arrival of boats; 9th, large number of steamers passing southward, ice nearly disappeared; 11th, 12th, heavy ice, navigation suspended; 16th, ice rapidly disappearing, boats resumed trips. Louisville, 6th, river full of floating ice; 7th, mail boats stopped running; 8th, river clear. Portsmouth, Ohio, 2nd, heavy floating ice, navigation closed; 9th, navigation opened; 13th, heavy floating ice, navigation again closed; 15th, navigation open, river partially clear. *Cuyahoga River.*—Cleveland 9th, ice breaking up, but current not strong enough to carry it out to lake; 10th, gorged

at mouth, the ice being packed solid to the bottom, water rose at the rate of one inch per minute, soon overflowing wharves and warehouses, gorge finally broken by the firing of artillery; 11th, ice in Lake still solid. *Sandusky Bay*.—Sandusky, 10th, ice remains solid. *Detroit River*.—Detroit, 9th, floating ice; 10th, river clear. *Louisville and Portland Canal*.—Louisville, Ky., 6th to 10th, frozen over; 11th, ice breaking up; 14th, clear of ice. *Monongahela River*.—Pittsburg, 10th, ice gorged, causing considerable damage to property. Morgantown, 1st, ice breaking up; 3rd, gorged, carrying away river gauge, most extensive and destructive gorge ever experienced; 10th, gorge broke and passed down. *Genesee River*.—Rochester, 10th, ice breaking up; 11th, river clear, but rising rapidly and flooding the low lands; 12th, gorged below the Lower Falls. *Oswego River*.—Oswego, N. Y., 12th, ice gorged above the bridge, no serious damage resulting. *Susquehanna River*.—Catawissa, Pa., 10th, "North Branch" has remained solid for the past 76 days; 11th, commenced breaking up and finally passed out without appreciable damage to property. Milton, Pa., 10th, "West Branch," ice breaking up, Limestone Run overflowing; 11th, heavy floating ice, river rising rapidly; 12th, floating ice, river rose 17 feet, no serious damage; 13th, river clear and falling. *Potomac River*.—Washington, D. C., 12th, ice broke up, carrying away about 600 feet of the "Long Bridge," lower portion of city flooded, causing great damage to property. *Chincoteague Bay*.—Chincoteague, Va., 1st to 10th, closed with ice; 9th, large fields of ice extending north and south and several miles out to sea; 11th, ice breaking up and passing out rapidly. *Delaware Bay*.—Delaware Breakwater, 2nd, gorged with ice as far as the eye could reach; 3rd, steamer "D. J. Foley" ice bound opposite station and leaking badly; 7th, ice outside breakwater commenced moving; 9th, ice leaving and returning to the harbor with the movement of the tides; 11th, harbor full of floating ice; 13th, harbor entirely clear. *Pamlico Sound*.—Portsmouth, N. C., 3rd, frozen over to the channel. *Coro Sound*.—Cape Lookout, N. C., 1st to 3rd, ice formed, sufficient to stop navigation. *Chesapeake Bay*.—Cape Henry, 6th, large quantities of ice floating out to sea. Baltimore, 1st to 6th, heavy floating ice, navigation dangerous; 10th, navigation closed; 11th, upper harbor clear, river frozen solid from shore to shore except portion of channel near mouth, ice in bay passing out; 13th, river and bay clear of ice, navigation reopened; 14th, harbor entirely clear; 21st, Bay Line steamers resumed regular trips. *Little Egg Harbor*.—Little Egg Harbor, N. J., 3rd, 4th, sound nearly frozen over; 8th, 9th, ice breaking up but tides too low to carry it out; 12th, ice drifting badly, navigation impossible; 13th, sloop "Mary E. Mott" damaged by ice and abandoned; 15th, ice passing out, telegraph cable carried away; 17th, clear of ice. *Delaware River*.—Trenton, N. J., 1st to 12th, frozen over; 13th, ice breaking up and passing down. *Hudson River*.—Garrisons, N. Y., 28th, river still frozen over, teams crossing or driving on the ice to neighboring towns. *New York Bay*.—New York City, 1st to 3rd, heavy floating ice, seriously impeding navigation; 4th, clear of ice; 18th, heavy floating ice in river and bay. *Long Island Sound*.—3rd, sound nearly frozen over, navigation closed. New Haven, 4th, navigation seriously impeded by heavy floating ice, steamers report 60 miles of ice from Hell Gate eastward. New London, 3rd, 4th, harbor full of ice, navigation suspended; 5th, ice breaking up along shore; 8th, first boat of the usual coal fleet arrived after a rough experience of 60 miles of heavy ice, first arrival since January 24th; 9th, ice breaking up along shore and running out; 11th, British steamers closed in ice since January 26th were towed out; 12th, light ship from Comfield Point cut adrift by the ice and found in a large floe near Plum Island; 25th, ice forming along shore; 28th, harbor full of floating ice. *Vineyard Sound*.—Wood's Holl, 1st to 4th, full of floating ice, navigation impossible; 8th, large number of vessels ice-bound in the harbors of Martha's Vineyard and Nantucket; 10th, full of floating ice, steamer "Island Home" ice-bound within a few miles of Nantucket. *Narragansett Bay*.—Newport, R. I., 1st, ice forming rapidly in inner harbor; 2nd, only the largest steamers can force their way through the ice; 7th, ice breaking up and passing out; 8th, boats resumed regular trips. *Massachusetts Bay*.—Boston, 1st to 3rd, large quantities of floating ice; 8th, ice nearly passed out; 13th, entirely clear. *Connecticut River*.—Hartford, 3rd, ice 36 inches thick, no signs of breaking up. *Passamaquoddy Bay*.—Eastport, Me., 10th, floating ice; 13th, clear.

*Floods*.—Under this heading it becomes necessary to note one of the most important features of the month, and in connection therewith to consider two predominating influences in the production of remarkably serious consequences that have resulted in a vast destruction of property, the counterpart of which has not transpired in some sections for 20 years. These two causative elements have been confined to different periods of the month and widely separated portions of the country. The first, a result of excessive precipitation, was experienced throughout the Pacific coast and Northern Plateau regions and along the Western Gulf coast between the 1st and 6th; the second, due to continued high temperatures, the maximum of the month, operated throughout the Ohio valley and Middle States, in northern Ohio and Indiana from the 10th to the 16th, suddenly releasing the ice bound rivers and converting the huge snow-drifts into torrents of water. The following reports will be found of interest: *California*: Red Bluff, 1st to 3rd, rivers and creeks rising rapidly; great damage to lumber companies; bridges and railroad tracks washed away; ranches suffered great loss from the destruction of fences, buildings and growing grain; stock killed; all communication suspended; 4th, Sacramento River reached 28 feet and 6 inches above low-water mark, highest point ever recorded. Sacramento, 4th, river rose to 26.5 feet above low-water

mark, highest ever recorded. Town of Washington flooded to a depth of 6 feet; most of the people removed to Sacramento for safety; for miles to the south and west the country was completely covered with water. Rio Vista, 1st to 5th, very heavy floods submerging all the cultivated islands in the Sacramento and San Joaquin rivers, probably rendering them unfit for cultivation for the next three years; 5th, water reached highest point or within 10 inches of the flood of January, 1862. Oroville, 3rd, highest water ever seen by the oldest inhabitant; several buildings carried away; the gas works, composed of brick buildings, wood-sheds and dwellings, entirely swept away; velocity of current was such that an engine weighing 1½ tons and set on heavy oak timbers was carried 100 yards; a galvanized tank, containing 1,000 gallons of crude oil, found 15 miles from works. *Oregon*: Umatilla, 1st to 3rd, Umatilla and Columbia Rivers rose very high; lowlands all flooded; buildings, fences and bridges swept away; great loss to railroad companies from the carrying away of cut timber. Throughout eastern Oregon the destruction of property has been enormous; among the farmers the loss is estimated at \$300,000; in the city of Portland alone it will reach about \$100,000, while the railroad companies have lost not less than \$125,000. *Washington Territory*: Pomeroy, 1st, Pataha creek overflowed; water 2 to 4 feet deep in the streets; people departing for places of safety; 2nd, all bridges gone; roads impassable. *Idaho*: Boise City, 2nd, Cottonwood creek above its banks; streets covered with water; bridges, fences, side-walks and buildings carried away; cellar walls caved in; all communication and business closed. *Florida*: Pensacola, 6th, water highest ever known; wharves, bathing houses, business buildings, lumber yards and rafts of timber suffered great damage; over 100 vessels in harbor when storm began, many of which were seriously injured by dragging anchors, grounding and collisions. *Louisiana*: New Orleans, 6th, Lake Ponchartrain overflowed, water covering a large portion of city to a depth of three feet: worst storm for many years: 10,000 people thrown upon the mercies of the city; loss of property and suffering unprecedented: all railroad and telegraphic communication cut off. The settled portion of city inundated covers about five square miles and contains probably 50,000 inhabitants; in one-story houses everything was washed out. The loss of property along the coast of Mississippi Sound, from Bay St. Louis to Pascagoula, is estimated at over \$100,000. Pass Manchac, 8th, terrific storm of wind and rain from the southwest, city completely drowned out; every building except the depot and telegraph office carried away. *Alabama*: Mobile, 7th, lower portion of city flooded, business entirely suspended; all communication by railroad or telegraph completely cut off by huge washouts and the destruction of bridges. *Illinois*: LaSalle, 11th, portion of Rock Island R. R. bridge swept away; Illinois River rose 12 feet above low-water mark, all the low lands submerged; barns and houses carried away; several families left homeless. Ottawa, 11th, highest water since the flood of 1856; all bridges on the Fox and Illinois Rivers more or less injured; water covers the bottom-lands and prairies for miles. *Indiana*: Crawfordsville, 10th, most disastrous freshet ever before experienced; mill-dams, bridges, fences and buildings carried away. Fredericksburg Pike, 11th, iron bridges across Walnut Fork and Shamondale Pike carried away; loss, \$10,000 to \$15,000. Sullivan, 10th, all streams flooding the country: Wabash River highest for many years: railroad bridge carried away; loss, \$175,000. Marion, 10th, railroad bridge over the Mississnewa River carried away; all railroad and telegraphic communication cut off. Spencer, 10th, two spans of the State House quarry bridge carried away; much damage to other property. Indianapolis, 10th, Eagle Creek rose above its banks, carrying away buildings and drowning stock. Fall Creek very high and rising rapidly; people in vicinity compelled to abandon dwellings and ford the water, waist deep, to higher ground. Pogue's Run rose above the floors of the bridges and many crossings within the city limits, water nearly as high as the great flood of 1875. Mitchell, 11th, White river higher than during the great flood of 1875, water rising five inches per hour; great damage to fencing, outbuildings and growing crops. Dayton, 11th, Wild Cat creek higher than ever before, low lands entirely submerged, great damage to growing crops. Lafayette, 11th, Wabash river higher than ever before remembered, bottom lands covered to a depth of several feet, streets in lower portions of city submerged. Elkhart, 11th, all streams highest for many years, all railroad communication closed, tracks badly washed and bridges partially destroyed. Columbus, 11th, Clifty river highest ever known; portion of city flooded; large turnpike bridge over river river carried away, causing a loss of \$50,000. *Ohio*: Toledo, 10th to 14th, most disastrous flood ever experienced; principal streets of the city submerged to a depth of from three to six feet; buildings floated from their foundations; bridges, sidewalks and fences carried away and hundreds of packages of mail matter soaked with water; entire losses reach into the millions. Compared with the great floods of 1847, 1855, 1866, 1869 and 1876 the water reached a higher point than ever before recorded, except in 1847 and 1866. Grand Rapids, 12th, highest water for many years; city partially flooded; bridges and fences carried away. Napoleon, 11th, water higher than the great flood of 1867; much damage to property. Canton, 10th, streets flooded, streams higher than for many years past, bridges carried away and all railroad traffic suspended; county roads impassable, much damage in the agricultural sections. Columbus, 10th, all streams overflowed; much damage to bridges, fences and buildings; all railroad and telegraphic communication suspended; Scioto river higher than during the great flood of 1869. Wellsville, 11th, part of the town completely submerged, water in some of the streets six feet deep, several bridges carried away. Steubenville, 11th, water 37 feet above low-water mark,

lower part of city inundated; people of New Cumberland, on opposite side of river, compelled to flee to high ground for safety. Marietta, 11th, water 38 feet above low-water mark, streets flooded, river nearly a mile wide, much damage to bridges and buildings. Cleveland, 10th, highest water for many years; streets, wharves and warehouses flooded. Warren, 11th, Makoning river highest for many years, whole south end of city one vast lake, 1,500 people obliged to leave their dwellings, nearly all of the manufactories of the city were flooded, business generally suspended. New Comerstown, 11th, Tuscarawas river higher than for the past 30 years, railroad trains discontinued, bottom lands submerged and corn, hay, fodder and fences carried away. Dayton, 11th, highest water since the great flood of 1866; houses in northern part of city flooded; water rapidly approaching the southern portion, where many people left their houses for places of safety. Sidney, 11th, Miami river highest for 13 years. Port Jefferson, 11th, iron bridge carried away; much damage to other property. Chagrin Falls, 11th, Chagrin river highest since the flood of 1878; great damage to farmers along the bottoms. Youngstown, 11th, water highest since flood of 1878; 50 to 60 dwellings flooded and abandoned; business suspended; all communication cut off; all bridges throughout the county more or less damaged, causing a loss of about \$20,000. Bucyrus, 11th, Sandusky river above its banks; railroad bridge carried away; much damage in city and country round about. Mt. Vernon, 11th, Kokosing river highest for many years; great damage to bridges, fences, buildings and other property. Newark, 11th, heavies flood for many years; great destruction to county bridges; farmers suffered heavy losses. Lorain, 11th, Black river overflowed and highest for years; great damage to property in the low lands; several bridges carried away. Delaware, 11th, highest water ever known; several mill-dams carried away. *Pennsylvania*: Harrisburg, 10th, Susquehanna and Juniata rivers rose at the rate of two feet per hour; railroad tracks, for the distance of a mile, submerged to a depth of three feet. Meadville, 11th, highest water for years; 200 families compelled to abandon their houses; all cellars in the business part of the town flooded, causing great loss to merchants; all railroad and telegraphic communication cut off; several bridges carried away. Oil City, 11th, everything flooded; great damage to property; bridges and railroad tracks washed out. Washington, 11th, Chartier's creek overflowed; water rising 12 inches per hour; bridges, fences and buildings carried away. Woodville, 11th, water highest ever known; families compelled to leave their dwellings on horseback or in boats. Cannonsburg, 10th, highest water for many years; many dwellings abandoned for places of safety; great loss of property and much suffering. Hamilton, 11th, Juniata river highest for years, bridges carried away and all railroad and telegraphic communication cut off; throughout Dauphin county the damage done by small streams is very great, nearly all of the bridges have been destroyed and travel of all kinds seriously impeded. Wilkesbarre, 11th, Susquehanna river twenty feet above low-water mark, several bridges destroyed, the flats opposite the city were entirely under water and many telegraph poles were carried away. Newport, 11th, Juniata river very high, portion of bridge carried away, many families have abandoned their houses for places of safety. Schuylkill Haven, 11th, all of the lower portion of city submerged, water rose so rapidly that many people were obliged to take refuge in upper rooms of their houses until boats were procured to convey them to places of safety. Milford, 11th, Delaware river highest ever known, portion of city flooded, great destruction. *West Virginia*.—Parkersburg, 11th, river 32 feet above low-water mark and rising at the rate of five inches an hour. Pomeroy, 11th, river 34 feet above low-water mark and rising at the rate of six inches an hour. Point Pleasant, 11th, river 30 feet above low-water mark and rising rapidly. Charleston, 11th, Kanawha river 18 feet above low-water mark and rising six inches per hour. Hinton, 10th, New river 10 feet above low-water mark and rising. *New York*.—Elmira, 11th, Chemung river and other streams in vicinity overflowed, highest water for several years, hundreds of acres in eastern part of city submerged and many dwellings deserted, people passing about in boats and upon rafts. Port Jarvis, 11th, Delaware river overflowed, lower portion of city flooded, many families leaving for places of safety, much damage to property here and throughout the Delaware valley. Rondout, 11th, all railroad communication suspended, very heavy floods and much destruction to property in Dutchess and Columbia counties. Poughkeepsie, 11th, Wappinger's creek overflowed, several bridges carried away and much other damage done, on some of the country roads water was eight feet deep. Lackawaxen, 11th, river 25 feet above low-water mark and rushing by with fearful velocity carrying everything before it, much destruction of property. *North Carolina*.—Elsworth, 7th to 9th, all streams highest for years, large washouts and heavy land slides along railroad tracks, much damage in surrounding country. *District of Columbia*.—Washington, 12th, Potomac river overflowed, lower portion of city completely inundated, water highest ever known, people passed about in boats in front of the Metropolitan hotel and about the Baltimore and Potomac depot, houses and stores flooded above the first floors. *Maryland*.—Woodstock, 12th, Patapsco river highest for several years.

*High Tides*.—Pensacola, Fla., 6th, highest ever known, water rose five feet above high-water mark. New Orleans, 6th to 9th, very high. Indianola, 5th, unusually high. Galveston, 6th, very high. Mobile, 6th, remarkably high, flooding entire lower portion of city.

### TEMPERATURE OF WATER.

*The temperature of water*, as observed in rivers and harbors at Signal Service stations, with